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Material Study on LWC: A Review

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ABSTRACT

The use of lightweight concrete(LWC) for structural application has attracted great interest due to its significant benefit in terms of design flexibility and overall costing. A light weight insulative,structural concrete is produced from a cement mix containing lightweight aggregates having precisely defined physical and chemical properties. However,lack of information in terms of the structural performance such as the bond properties could be a hindrance to the application of LWC in the construction industry.Therefore a comprehensive investigation has been made in the study on the improvement of strength and ductility of concrete using lightweight aggregate concrete.This review also showed that generally the optimum result of LWC,complied with the requirements in codes of practice without the need for safety factors, and this further enhance the feasivility of LWC for structural applications.

CONTENTS:

1. INTRODUCTION

Concrete is the most widely used construction material throughout the globe. Especially in the developing regions of the world, construction of infrastructure constitutes the major share of the total development work. And concrete is an indispensible part of these development works in countries like Bangladesh as ingredients of concrete is inexpensive, readily available as well as concrete work is relatively simple to execute and maintenance free. However, the major limitation of concrete is the lack of ductility. In Bangladesh, this limitation is even more pronounced due to poor construction practice and lack of quality control. . This admixture helps to achieve increased workability without loss of strength, increase strength without loss of workability. The chemical, physical, mechanical properties confirming the specification. In recent decades, utilizing the mineral and chemical admixture in concrete technology has introduced light weight concrete as reliabsle construction material.In this paper light weight concrete it has the advantage of light weight and high strength so that it can effectively reduce the weight of concrete structure in practical engineering. The use of lightweight aggregates (LWA) in concrete is an interesting alternative to simultaneouslyreduce the total structure weight and provide both appropriate resistance and concrete's performance.This paper studies the influence of LWA on concrete, comparing the changes in the mechanical properties,pore structure and fluid transport related to the increase of LWA content. Results reveal that although

LWA reduces the mechanical properties of the studied samples does not significantly affect the fluid transport properties. Total porosity rises with LWA content whereas open porosity remains nearly invariable. LWA pores do not totally participate in the fluid transport through the concrete and, consequently, fluid transport through lightweight concrete is limited by the continuity and accessibility of the LWA pores and is dominated by the properties of the mortar matrix. Structural lightweightaggregate concrete (LWAC) offers such advantages as reduced dead load and decreased slab and beam size of concrete structures. To this may be added the economic advantages of artificial lightweight aggregates (LWA). However, LWAC basically suffers from higher porosity and water absorption compared to normal-weight concrete. Ultra light weight cement composite with different types and dosage of fibres together with 15% and 30% replacement of cement. They are polycarboxylate based superplasticizers used for workability the materials such as fibre, silica fume, glass, flyash, cement, and steel fibre that are explained. A single NDC mixture, with a compressive strength of 50 MPa, and three LWAC mixtures, with density range between 1500 and 1900 kg/m^3 and compressive strength between 45 and 75 MPa, were adopted.

2. LIGHTWEIGHT CONCRETE

Conventional cement concrete is the building material. For the structure such as multistory buildings it is desirable to reduce the dead load. Light weight concrete (LWC) is most suitable for such construction works. It is best produced by entraining air in the cement concrete and can be obtained by anyone of the following method. By making concrete with cement only some times such as concrete is refer to as no fines concrete. Light-weight concrete(LWC) can be defined as the type of concrete which includes an expanding agent in that it increases the volume of the mixture while giving additional qualities. The main specialties of lightweight concrete are its low density and thermal conductivity. The lighter materials can be used in concrete construction and has an economical advantage.

Ordinary concrete is quite heavy and its density is 2300 kg/m^3. It is not suitable for use in floor filling as filler in general. If used, it adds considerably to the dead weight of the structure. By using suitable aggregates the density of concrete can be reduced. This light weight concrete not only results in reducing dead weights on structure, but also has a better insulation against heat and sound. The strength of such concrete is however low. But it is of no consequence as this concrete is not expected to bear any loads. Because of the light weight, this concrete is very suitable for earthquake proof structures. Density of light weight concrete various from 300 – 1200 kg/m^3. due to the low density and the characteristic texture of porous aggregates especially in the crushed state the workability of concrete need special attention. In general placing compacting and finishing light weight aggregate concrete requires relatively loss effort therefore even 50 to 75 mm slump may be sufficient to obtain workability of type that is show by 100 to 125 mm slump of normal weight concrete. Design strength of light weight concrete 20 to 35 Mpa,28 days compressive strength are common, although by using a high cement content a good quality of light weight aggregate small size has made it possible, in some precast and prestressing plants, To produce 40 to 48 Mpa concrete. Light weight aggregate with controlled micro porosity have be developed to produce 70 to 75 Mpa, light weight concrete which generally 18.40 to 20 KN/m^3 .The ratio between the splitting tensile stress and compressive strength decreases significantly with increasing strength of light weight concrete.

3. OBJECTIVE

Lightweight concrete can be defined as a type of conctete which includes an expanding agent in that in increases the volume of the mixture while giving additional qualities such as dead weight. It is lighter than the other concrete. The use of lightweight concrete has been widely spread acorss countries such as US,the main specialities of lightweight concrete are its low density and thermal conductivity. Its advantages are that there is a reduction od dead load, faster building rates in construction and lower haulage and handling costs. Lightweight concrete maintain its large voids and not forming laitance layers or cement. This performance of aerated lightweight concrete,however suffivient water cement ratio is vital to produce adequate cohesion between cement and water. Insufficient water can cause lack of cohesion between particles, thus loss in strength of concrete. Likewise too much water can cause cement to run off aggregate to form laitancfe layers subsequently weakens in strength. Therefore, this fundamental research report is prepared to show activities and progress of the lightweight concrete. Focused were on the performance of aerated lightweight concrete such as compressive strenght tests, water absorption and density and supplementary tests and comparison made with other types of lightweight concrete.

4. SCOPE

• Light-weight concrete can be defined as the type of concrete which includes an expanding agent in that it increases the volume of the mixture while giving additional qualities.

- In design of concrete plays a prominent role in reducing the density and increase the thermal insulation. This paper develops a new type of ultra-lightweight concrete of low level density.
- The use of light weight concrete permits greater design flexibility and substantial cost saving, reduced dead load.
- Hence there is a lack of high increase in density by lacking of concrete.

5. LITERATURE REVIEW

Hossein Fashandi, Hamid Reza Pakravan, Masoud Latifi (2019) "Application of modified carpet waste cutting for production of eco-efficient Light Weight Concrete", In thisstudy, an attempt has been made to study the Mechanical Properties and Physical Properties of light weight concrete using the materials such as Carpet Waste, Cement, Asphalt Soil, Light Weight Aggregate. For this purpose along were prepared to study the compressive strength, Water absorption test, and flexural strength. Slump test were carried out for each mix in the fresh state. 28-days Compressive test and Flexural Strength tests were performed. The study is also extended to suggest a new application for this kind of synthetic fiber. This reduce rate of disposal and protect environment and production as this material increase ductility and load-bearing capacity of concrete. The test results showed in Compressive strength 29.9 MPa, Water absorption 6.8% to 9.3% .

Behnam Vakhshouri, Shami Nejadi (2018) "Size Effect and Age factor in Mechanical Properties of BST Light Weight Concrete", Replacement of whole or part of normal aggregate with expanded polystyrene cylinder specimen 75x150, 100x200 and 150x300mm dimension and cube specimen 100 and Compressive strengths, Tensile Strength and Water Absorption

Strength. This admixture helps to achieve increased workability without loss of strength, increase strength without loss of workability. The chemical, physical, mechanical properties confirming the specification. In recent decades, utilizing the mineral and chemical admixture in concrete technology has introduced light weight concrete as reliable construction material.

Juan Daniel Martinez, Santiago Betacourts-paraa, Ivonne carvajal-marin (2018) "Ceramic Light Weight Aggregate product from Petrochemical waste and carbonate as expansion agents ", This study is intended to explore thevalorization of an importance hazardous waste for the synthesis of potential material for construction. The materials are such as ceramic aggregate, Expanded aggregate, Hazard petroleum waste, both the waste are produced in the petro chemical processing industry and it was provided from a colombian oil company. All raw materials were mixed and comfirmed manually without water addition. In morphology analysis Light Weight Aggregate obtained 900 degree Celsius and oil waste 40% weight both $caco_3$& $NAHco_3$.

Yuan Ren, Zhenpeng Yu, Qia Huang, Zheng Ren ,(2018) "Constitutive model and failure criterions for Light weight aggregate concrete –A true triaxial experiments test", In this paper light weight concrete it has the advantage of light weight and high strength so that it can effectively reduce the weight of concrete structure in practical engineering. In this multiaxial test has been conducted on light weight concrete. According to experiment of light weight aggregate concrete stress-strain curve under different loading condition are obtained. The failure criterion of light weight aggregate concrete has been proposed based on the test result and twin shear theory. The proposal model can be well predict the strength of light weight aggregate concrete under triaxial compression. The test such as compressive test and triaxial test were conducted.

K.M.A.Sohel, K.A.Jabri, M.H.Z hang, (2018) "Flexural Fatique behavior of ultra lightweight cement composite and high strength light weight aggregrate concrete." In this study, the fatique performance of ultralight weight cement composite the light weight concrete subjected to flexural load. The average 28 days cylinder the compressive strength of the light weight aggregate concrete were 62MPa and 63MPa. Flexural fatique behavior in this study in comparison of high strength light weight aggregate concrete. The ULCC contains the materials such as Ordinary Portland Cement, Silica fume, Polyvinyl alcohol. In order to reduce shrinkage strains and air contents. Since fatique is more important factor of design concrete structure. Test conducted such are Compressive strength, fatique .Based on experiments and theoretical investigations they absorbed different stress level were performed. More research work is necessary to generate additional fatique data for the newly developed material with different proportion of materials and mineral admixtures.

Zhenyu Huang, Krishnan Padmaja, Shan Li (2018) "Mechanical properties and microstructure of ultra light weight concrete composite with flyash cenosphere after exposure to high temperature", This paper investigates the mechanical behavior and micro-structure of new type of ultra weight at 900 degree Celsius. To prevent spalling of ULLC material when exposed to high temperature, synthetic fibres are needed. In this paper, ULLC materials comprising eight difference mixtures considering different content of polypropylene, steel fibres, hybrid fibres, flyash replacement for cement are examined. Micro structural characteristics before and after exposure to temperature deterioration by using scanning electron microscopy. Ultra light weight cement composite with different types and dosage of fibres together with 15% and 30% replacement of cement. They are polycarboxylate based superplasticizers used for workability the materials such as fibre, silica fume, glass, flyash, cement, and steel fibre that are explained.

C.Pla, A.J.Tenja Abril, J.Valdes-Abellan (2018)," Influence of microstructure on fluid transport and mechanical properties in structural concrete produced with light weight clay aggregate",.The use of lightweight aggregates (LWA) in concrete is an interesting alternative to simultaneouslyreduce the total structure weight and provide both appropriate resistance and concrete's performance.This paper studies the influence of LWA on concrete, comparing the changes in the mechanical properties,pore structure and fluid transport related to the increase of LWA content. Results reveal that although

LWA reduces the mechanical properties of the studied samples does not significantly affect the fluid transport properties. Total porosity rises with LWA content whereas open porosity remains nearly invariable. LWA pores do not totally participate in the fluid transport through the concrete and, consequently, fluid transport through lightweight concrete is limited by the continuity and accessibility of the LWA pores and is dominated by the properties of the mortar matrix.

Noureddine latroch, Yassine Senhadiji (2018), " Physico-mechanical and thermal properties of composite mortars containing light weight aggregate of expanded polyvinyl chloride", Expanded polyvinyl chloride (PVC) or ''FOREX'' is widely used in advertising and signage boards, shop fittings and shop window decorations. This article attempts to study the physico-mechanical and thermal properties of lightweight composite mortars based on expanded polyvinyl chloride (LMEPVC), in which the natural sand are replaced by lightweight aggregates from expanded PVC sheets, with different volume proportions (0, 15, 25, 50 and 75%). The consistency, density, porosity accessible to water, mechanical strengths (compressive and flexural tests), ultrasonic pulse velocity (UPV), dynamic modulus of elasticity (Ed), and thermal conductivity are measured on various LMEPVC samples. Scanning electron microscopy (SEM) for microstructural analysis is performed to elucidate the mechanism of strength development. The results obtained showed that reduce the specific weight of the LMEPVC composites and improve their thermal insulation, particularly the composite LMEPVC75 (k = 0.760 W/m.K). On the other hand, the dynamic modulus of elasticity (Ed) of that same composite was found to decrease by about 66% as compared to that of the referece mortar.

R.N.F.Carmo, H.Costa (2018) ," Influence of light weight aggregate concrete on the bond strength concrete-to-concrete interfaces'', An experimental study carried out to characterize the bond strength of lightweight aggregate concrete (LWAC) to normal density concrete (NDC) and LWAC-to-LWAC interfaces is presented, also including NDC-to-NDC interfaces as reference. A single NDC mixture, with a compressive strength of 50 MPa, and three LWAC mixtures, with density range between 1500 and 1900 kg/m^3 and compressive strength between 45 and 75 MPa, were adopted. Slant shear and splitting tests were conducted to evaluate the interface bond strength, considering different methods to increase the surface roughness of the substrate. Results were analysed and compared with predictions according to Eurocode 2 (EC2) and fib Model Code 2010, and showed significant differences, mainly for rough surfaces. It was found that the role of the binding matrix strength and of the type of aggregate, in the interface strength, is dependent of the roughness of the substrate; the coefficients of cohesion and friction exhibited a good correlation with the roughness parameter ''mean peak high", Rpm, being the cohesion also influenced by the matrix strength of the added concrete. It was also concluded that there is no advantage, in terms of shear and tensile strengths of interfaces with LWAC, to increase the surface roughness above a certain limit.

Hatice Oznur Oz(2018)"Properties of previous concrete partially incorporating acidic pumice as coarse aggregate'' Using pervious concrete (PC) as a pavement material in low-volume road applications has gained great importance since its positive environmental benefits. The paper presented herein addresses the prospective use of acidic pumice aggregate in pervious concrete. At a constant water/cement ratio of 0.30, two control concretes were produced with only crushed stone aggregates with cement contents of 300 and 420 kg/m^3, respectively. Thereafter, the acidic pumice were replaced with the crushed stone at 10%, 20%, 30%, 40% and 50%, respectively by total aggregate volume. A total of 12 pervious concretes (PC) were produced and tested for the compressive, split tensile, and flexural strengths as well as the total void ratio and permeability at 28 and 90 days. Additionally, the surface abrasion resistances of PCs incorporating pumice were tested at 90-day. Test results have revealed that the PCs incorporating pumice had better water permeability and surface abrasion resistance, irrespective of the replacement level. However, the compressive, splitting tensile test are carried out.

Gemma Rodriquezde Sensale, Lliana Rodriguez Viacava(2018) "A study on blended

Portland cement containing residual rice husk and limestone filler" The cement industry is responsible for large CO_2 emissions. Residual rice husk ash (RRHA) can contribute both to a reduction of the environmental impact of cement manufacturing as well as to the agro-energy chain. The objective of this study is to obtain Blended Portland Cement (BPC) with up to 35% substitution of cement by RRHA and limestone filler. On the analysed mixtures, properties required by BPC standards, alkali-silica reaction, and effects of mineralogy and microstructure on BPC properties are discussed. The mixtures satisfy standard BPC requirements and lead to a reduction in CO2 emissions when compared to Portlandcement.

Nafise Hosseini Balam, Mohamdreza eftekhra(2017) "Effective of bacterial remediation on compressive strength, water absorption and chloride permeability of light weight aggregate concrete " Structural lightweight aggregate concrete (LWAC) offers such advantages as reduced dead load and decreased slab and beam size of concrete structures. To this may be added the economic advantages of artificial lightweight aggregates (LWA). However, LWAC basically suffers from higher porosity and water absorption compared to normal-weight concrete. Due to the negative side-effects of certain chemical techniques, biological methods have been proposed as an environmental friendly strategy for reducing concrete porosity and diminishing water absorption. In this regard, calcium carbonate precipitation induced by micro-organisms has found wide applications in construction technology for its effect on improved quality of building materials. This paper presents the results of an experimental investigation carried out to evaluate the influence of Sporosarcina pasteurii at cell concentrations of 106 cells ml 1 on water absorption, water permeability, compressive strength, and rapid chloride permeability (RCP) of LWAC. For the purposes of this study, Leca aggregates were left to soak in a solution of urea-$CaCl_2$ containing bacteria for 6 days to investigate biological improvement of aggregate quality. Next, four types of LWAC were made under the three treatments of bacterially-treated aggregates, bacteria inoculated in the concrete mix water, and both techniques employed simultaneously and with no bacteria used in either the aggregate or the concrete mix solution as the control. The results revealed an average reduction of about 10% in water absorption, 20% increase in compressive strength, and 20% reduction in chloride penetration in the experimental specimens relative to the same properties in the control ones. Furthermore, scanning electron microscopy (SEM) analysis revealed denser and lower porosity of LWAC specimens with bacteria in their concrete mix water and aggregates as compared to those with bacteria used only in their concrete mix water.

Danuta-Barnat, Malgorzata franus(2017) "The use of zeolite, light weight aggregate and boiler slag in restoration renders" For the protection of walls against salt-damp, various renders with different aggregates are proposed. The purpose of this study is to investigate the impact of natural zeolite, lightweight aggregate and boiler slag additives in the production of cement-lime renders meant for salty walls. The article presents laboratory examinations of their basic physical parameters such as water absorption, capillary absorption, water vapour permeability, absorptivity, sorptivity, density, total porosity, compressive and flexural strength. In addition to studies of the basic physical properties of the renders, frost and chemical corrosion resistance tests were conducted. Special additives to improve the properties were used such as hydrophobizer, methyl cellulose – a water-retaining additive, ethylene vinyl acetate copolymer powder, as well as a redispersive additive to improve adhesion. Apart from white Portland cement CEM I 52.5 R, blast furnace cement CEM III was also used, wherein the composition contains coal ash. The highest efficiency of render corrosion protection was obtained by the renders with Portland Cement CEM I 52.5 R and boiler slag. The experimental results showed that the mortars modified by natural zeolites and boiler slag, thanks to their porous structure, are distinguished by good sorption properties and can accumulate in themselves a sufficient amount of salt and ice.

PeiyaonLiu, Rifat Farzana, Veena Sahajwalla(2017) "Light weight expanded aggregate from the mix of waste automotive plastics and clay" Significant amount of waste associated with end of life vehicles enter waste stream each year/ and are usually disposed of in landfill, creating an environmental burden. Recycling automotive waste is very tedious and difficult due to its heterogeneous composition and nature. It is critically required to develop a solution to recycle and reuse these potential resources. In this paper, a novel recycling approach is established to produce lightweight aggregate by incorporating automotive shredded residual (ASR) plastics into clay at 1200ºC. The physical properties of lightweight aggregate such as bulk density, porosity and water absorption have been investigated. ASR plastics as pore-forming or gas releasing agent increased the porosity of the clay mixture. Incorporation of 2 wt% of ASR plastics into clay composite lead to a benefit of approximately 30% bulk density decrease and 40% porosity increase compared to the reference clay material used in this study. The obtained superior lightweight and porous aggregate products by using ASR plastics can be used in thermal insulation materials and also as substrates in soilless cultivation. This innovative approach could also help reduce the volume of autoplastics in landfills and could be a potential replacement of conventional additives in manufacturing composite materials for building applications.

Yuanhang Chen(2017) "A mix design method of light weight aggregate self-compacting concfrete based on packing and mortar film thickness theories" This paper puts forward a simple mix design method for lightweight aggregate self-compacting concrete (LWASCC) based on the packing and mortar film thickness (MFT) theories. The mix design method is composed of two simple stages: optimization of granular skeleton and optimization of cementitious materials composition. The former is conducted according to ASTM C 29 by packing different amounts of coarse and fine aggregates. The latter is carried out by using the minimum water requirement method. To verify its applicability for LWASCC, five mixture proportions with varying MFT (i.e., 1.4, 1.6, 1.8, 2.0 and 2.2 mm) were designed. The results showed that the proposed mix method is an effective method to develop LWASCC. The flow-ability increases with the increase of MFT. The compressive strength at 28 d and 56 d shows a contrary variation tendency compared with its early ages, which is attributed to the stiffness difference between aggregates and mortar at different age. The splitting tensile strength of MT-1.4 is higher than that of MT-1.6. With the increase of MFT ranging from 1.6 mm to 2.2 mm, the splitting tensile strength increases due to the decrease in the quantity of aggregate content and the positive effect of MFT on the aggregate/paste interface.

Table 1

Summary of literature review materials and density values.

S.NO	YEAR	MATERIALS	DENSITY (Kg/m3)
1	2019	Sintheticfibre,cement,asphalt soil	2180
2	2018	Natural aggregate 2 type of coarse aggregate, admixtures	2000
3	2018	Ceramic aggregate, expanded aggregate, Hazardous petroleum waste	2227
4	2018	Light weight aggregate concrete, cement, water, fine aggregate	1398
5	2018	OPC, aggregate cement, silica fume	1,870
6	2018	Fibre,silicafume,glass,flyash,cement,steelfibre	1000
7	2018	Light weight concrete, light weight aggregrate	3176
8	2018	Waste from expanded PVC sheets,superplaticizers	2300
9	2018	Concrete light weight aggregrate concrete	1900
10	2018	Crushed lime stone	4200
11	2018	OPC,rice husk ash,sand,clay,quartz,lime stone	1552
12	2017	Calcium carbonate leca aggregate	456
13	2017	Cement, ground granulated slag, LECA, Hydrated lime	2390
14	2017	Clay, shredded automative waste	1200
15	2017	Mineral admixture, chemical admixture	1950

S.NO	Y/M	SIF	C	AS	NA	CEA	EA	HPW	LWAC	SP	RA	CL	Q	L	GGS	CLS	HL	SAW	MA	CA	CS	SCS	EC	ESA
1	2019	1	1	1																				
2	2018				1																			
3	2018					1	1	1																
4	2018								1															
5	2018		2																					
6	2018	2	3						2															
7	2018									1														
8	2018								3															
9	2018															1								
10	2018										1		1	1										
11	2017		4												1		1							
12	2017											1						1						
13	2017																		1	1				
14	2017																				1	1		
15	2017																						1	1

MATERIAL STUDY ON LIGHT WEIGHT CONCRETE

SIF-Synthetic fibre, C-Cement, AS-Asphalt soil, NA-Natural aggregate, CEA-Ceramic aggrregate, EA-Expanded aggregate, HPW-Hazardous petroleum waste, LWAC-Light weight aggregate cocrete, SP-Superplasticizer, RA-Rice husk,CL-Clay, Q-Quartz, L-Limestone, CLS-Crushed limestone, GGS-Ground granulated slag, HL-Hydrated lime, SAW-Shreded automotive waste, MA-Mineral admixture, CA-Chemical admixture, CS-Ceramisite,SCS-Shall ceramisite,EC-Expanded clay, ESA-Expanded shale aggregate

Graph 1:

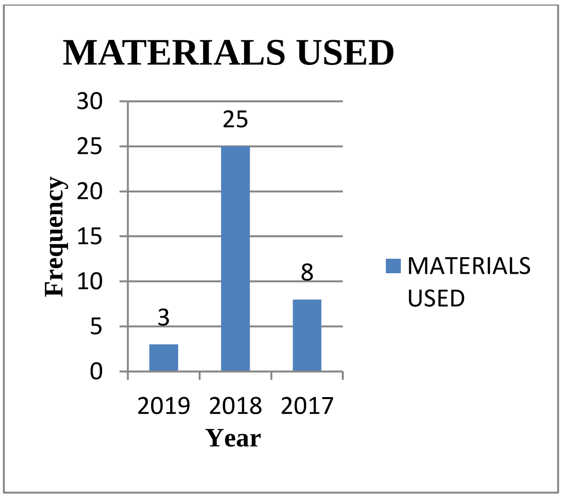

TABLE2:

Representation of test values.

S NO	YEAR	MATERIALS	TEST CONDUCTED	TEST VALUES
1	2019	Sintheticfibre,cement,asphalt soil	Compressive strength,Flexuraltest,Water absorption test	CS-29.9 mpa, WA-6.8%-9.3%
2	2018	Natural aggregate 2 type of coarse aggregate, admixtures	Compressive strength, water absorption, tensile	CS->17 mpa, WA-1.9%,

			strength	TS-1.5 mpa
3	2018	Ceramic aggregate, expanded aggregate, Hazardous petroleum waste	Compressive strength, water absorption	WA-45%
4	2018	Light weight aggregate concrete, cement, water, fine aggregate	Compressive strength, triaxial test	CS-39.57 mpa,TAT-23.99 mpa
5	2018	OPC, aggregate cement, silica fume	Compressive strength, flexural test, fatigue test	CS-50 mpa,FT-1to15 Hz,FT-0.90 to 0.60
6	2018	Fibre,silicafume,glass,flyash,cement,steelfibre	Compressive strength,water absorption test	CS-30 mpa
7	2018	Light weight concrete, light weight aggregrate	Compressive strength,porosity and density test	CS-38.4 mpa
8	2018	Waste from expanded PVC sheets,superplaticizers	Compressive strength, pulse velocity test,flexural strength test	CS-45.2 mpa,PVT-2.30%,FT-8 mpa
9	2018	Concrete light weight aggregrate concrete	Compressive strength,split tensile strength test	CS-75 mpa,STS-2.6 mpa
10	2018	Crushed lime stone	Compressive strength	CS-23.4 mpa
11	2018	OPC,rice husk ash,sand,clay,quartz,lime stone	Compressive strength,flexuraltest,blaine test	CS-35 mpa,FT-2.6 mpa, BT-5-20%
12	2017	Calcium carbonate leca aggregate	Compressive strength, porosity, water absorption, compressive, rapid chloride permeability test	CS-33.23 mpa, WAT-14%, CRCT-34%, PT-64.6
13	2017	Cement, ground granulated slag, LECA, Hydrated lime	Compressive strength, water absorption	CS-6.91 mpa, WAT-14%
14	2017	Clay, shredded automative waste	Compressive strength, water absorption, specific gravity	CS-12.39 mpa
15	2017	Mineral admixture, chemical admixture	Compressive strength, high strength, split tensile	CS-55 mpa,STT-3.19mpa

6. MATERIAL COLLECTIONS:

Cement: Ordinary Portland cement of 53 grades available in local market is used in this project.The Cement used has been tested for various proportions as per IS 4031-1988 and found to be confirming to various specifications of are IS 12269-1987.The specific gravity 3.

Figure 1: Cement

Flyash: Fly ash is also known as pulverised fuel ash in the United Kingdom. It is a coal combustion product that is composed of the particulates that are driven out of coal-fired boilers together with the flue gases.Ash that falls to the bottom ot the boiler is called bottom ash.In modern coal-fired powder plant ,flyash is generally captured by electrostatic precipitators.Fly ash is also known as pulverised fuel ash in the United Kingdom.

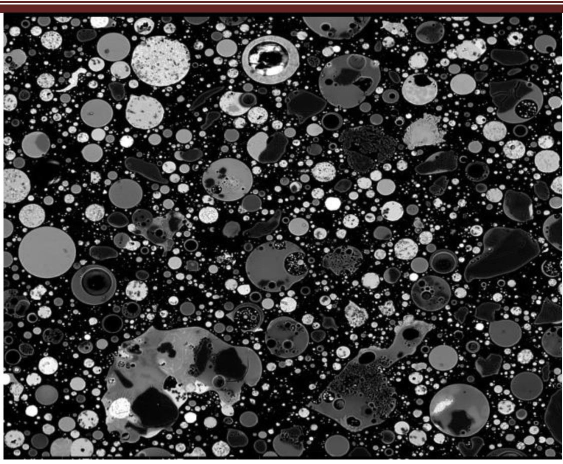

Figure2: Fly ash

Crushed Limestone: Limestone is a carbonate sedimentary rock that is often composed of the skletal fragments of marine orgnanisms such as coral and molluscs. About 10% of sedimentary rocks are limestones. Limestone has numerous uses as a building material, an essential component of concrete, as aggregate for the base of roads.

Figure 3: Crushed limestone

Water: Ordinary potable water without acidity and alkaniety available in the material testing laboratory was used.

7. SUMMARY FOR TESTING:

Water absorption Test

The concrete cube specimen of various concrete mixture of size 150mm wear cast and after 28 days of water curing the specimens wear removed from the curing tank and allowed to dry for one day. The weight of concrete cube specimens were taken.The pH was maintained throughout the period of 28 days. After 28 days of immersion, the concrete cubes wear taken out of water. Then, the specimens wear tested for compressive strength.

Figure 4: Water absorption test

Compression strength test

For the compression strength test of concrete 150 x 150 mm cubes are used and its tested as per BIS:516-1959. For each trail mix combination, three cubes were tested at the age of 7, 28 days of curing using 2000 KN capacity compression testing machine in Figure 5.5. The specimens shall be tested with the molded sides in contact with the plates. The load shall be applied witho

ut shock and increased continuously at a rate of approximately 140 kg/sq cm/min until the resistance of the specimen to the increasing load breaks down and no greater load can be sustained. The maximum load applied to the specimen shall then be recorded and the appearance of the concrete and any unusual features in the type of failure shall be noted.

Figure 5: Compression strength test

Split tensile strength test:

The tensile strength of concrete is one of the basic and important properties. Splitting tensile strength on concrete is a method to determine ttensile strength of concrete. The concrete is very weak in tension due to its brittle nature and is not expected to resist direct tension. The concrete develops crack when subjected to tensile forces. Thus it is necessary to determine the tensile strength of concrete to determine the load at which the concrete members may crack.

Split tensile strength is done as per IS5816: 1999. The test is conducted on compression testing machine of capacity 2000 kN. The cylinder is placed horizontally between the loading surfaces of compression testing machine and load is applied till failure of cylinder. During the test the platens of the testing machine should not be allowed to rotate in a plane perpendicular to the axis of the cylinder.

Figure 6: Split tensile strength test

Flexural strength test:

Flexural strength of concrete also known a modulus of rupture or bend strength is a material property defined as the stress in a material just before it yields in a flexure test. The transverse bending test is most frequently employed , in which a specimen having either a circular or rectangular cross-section is bent until fracture or yielding using a three point flexural test technique. The flexural strength represents the highest stress experienced within the material at its moment of yield.

Flexural strength test is done as per IS: 516: 1959. Prisms are testes for flexure in Universal Testing machine of capacity 500 kN. The bearing surfaces of the supporting and loading rollers are wiped clean before loading. The prisms are placed in the machine in such a manner that the load is applied to the upper most surface along the two lines spaced .The axis of the specimen is aligned with the axis of the loading device. The maximum load applied to the specimen during test is noted.

Figure 7: Flexural strength test

8. CONCLUSION:

- In recent literature review the materials we listed above were used many times in past 4 years.
- In this method of light weight cocrete the materials are mostly used in the year of 2018
- With addition of mineral admixtures, the compressive strengths of concrete are increased.
- Light weight aggregate is no way inferior to natural coarse aggregate and it can be used for construction purpose.
- The use of light weight concrete in reducing the density and increase the thermal insulation.

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